

SUPPORT FOR THE AMENDMENTS

Claims 1-32 are herein canceled. Applicants make no statement with respect to the propriety of the grounds for rejection of these claims and preserve the right to present the rejected claims in a continuation application without prejudice.

Claims 33-61 are new and are supported throughout the specification and original claims, especially Claims 31 and 32.

No new matter is believed added to this application by entry of this amendment.

Upon entry of this amendment, Claims 33-61 are active.

REMARKS/ARGUMENTS

The presently claimed invention is directed to a polarizing electrode for an electrical double layer capacitor which is prepared with an activated carbon. Conventionally activated carbon for use in electronic devices such as electrical double layer capacitors is washed with a strong acid and such a raw material suffers from the problem that problematic residual levels of alkali and heavy metals remain. These metals are reductively deposited to form metal dendrites which cause a problem of low rate of electrostatic capacitance retention due to the self-discharging which results from the dendrite formation.

Applicants have addressed this problem by providing a polarizing electrode for an electrical double layer capacitor according to Claims 33, 36 and 43 and claims dependent thereon and the methods for preparing the polarizing electrodes according to Claims 42, 52, 55, 56, 57 and claims dependent thereon. No such polarizing electrodes for an electrical double layer capacitor are disclosed or suggested in the cited references.

The rejection of Claims 1-2 and 4-9 under 35 U.S.C. 102(b) and under 35 U.S.C. 103(a) over Rodriguez-Reinoso, et al. (Carbon 1995:33(1): 15-23) is moot in view of the cancellation of Claims 1-2 and 4-9. Applicants respectfully note that this reference describes

activated carbon and neither discloses nor suggests a polarizing electrode for an electrical double layer capacitor as in the presently claimed invention.

Applicants respectfully note the discussion of inherency in the Office Action and the Examiner's position therein that "activated carbon that is "activated" by methods that do not employ alkali hydroxides (or any reagent with alkali metals) would not have an alkali metal content to report. Likewise, an activated carbon that was not treated by an alkali metal hydroxide and exposed to corrosive furnace conditions could be expected to be free of any "heavy metals."

Applicants respectfully submit that the description of sources of alkali metal and heavy metal contamination described in the specification were provided as examples and not intended to be a listing of the only sources. In fact, Applicants respectfully point out that raw natural carbonaceous materials can contain alkali and heavy metals at high levels. Support for this statement can be found in the article by Kim et al. (Hydrogen production by catalytic decomposition for methane over activated carbons: kinetic study; International journal of Hydrogen Energy; 29 (2004) 187-193), attached. Tables 1 and 2 in this article show that carbons activated by steam treatment, obtained from coconut and coal both have significant levels of alkali and heavy metals. Therefore, Applicants respectfully submit that activated carbons not treated with alkali metals do have high levels of metals and would not inherently have the metal contents described in the claimed invention.

In view of the above, Applicants respectfully submit that the cited reference neither discloses nor suggests a polarizing electrode for an electrical double layer capacitor according to Claims 33, 36 and 43 of the present invention and therefore cannot anticipate or render obvious the claimed invention. Accordingly, withdrawal of the rejection of Claims 1-2 and 4-9 under 35 U.S.C. 102(b) and under 35 U.S.C. 103(a) over Rodriguez-Reinoso, et al. (Carbon 1995:33(1): 15-23) is respectfully requested.

The rejection of Claims 1-2, 4-9 and 31-32 under 35 U.S.C. 102(b) and 35 U.S.C. 103(a) over Nakamura et al. (Influence of physical properties of activated carbons on characteristics of electrical double-layer capacitors; J. Power Sources; 60 (1996) 225-231) is respectfully traversed.

Nakamura neither discloses nor suggests a polarizing electrode for an electrical double layer capacitor, comprising: an activated carbon; at least one binder; and a conductive material, wherein the activated carbon is obtained by subjecting an easily graphitizable carbonaceous material to an alkali activation treatment, has an overall content of alkali metals of 60 ppm or less, and the easily graphitizable carbonaceous material is one selected from the group consisting of a petroleum coke, a petroleum pitch, a synthetic mesophase pitch, a polyvinyl chloride, a polyimide and a polyacrylonitrile.

Nakamura describes polarizable electrodes of double-layer capacitors obtained from activated carbons having differing physical properties, including activated carbons based on coconut shell and coal activated by steam. This reference is silent regarding alkali and heavy metal content and based on the Kim article cited above, an overall alkali metal content of 60 ppm or lower cannot be expected in the Nakamura activated carbon. For example, according to Kim, steam activated sample CCN-CI has an ash content of 3.10 % and 24 % of the ash is sodium. Therefore, the Na content alone of the activated carbon is over 7000ppm (.0031)(.24).

Applicants respectfully submit that as the cited reference neither discloses nor suggests a total alkali metal content of 60 ppm or less, nor even recognizes the importance of metal content to electrode performance. Therefore, Nakamura cannot anticipate or render obvious the currently claimed invention and withdrawal of the rejection of Claims 1-2, 4-9 and 31-32 under 35 U.S.C. 102(b) and 35 U.S.C. 103(a) over Nakamura is respectfully requested.

The rejection of Claim 3 under 35 U.S.C. 102(b) over Armstrong et al. (U.S. 5,883,040) is rendered moot by the cancellation of Claim 3. Armstrong does not disclose or suggest a polarizing electrode for an electrical double layer capacitor.

Armstrong describes a process for producing activated carbon from agricultural residues such as cereal hulls, rice hulls, fescue hulls, wheat hulls and oat hulls. This reference nowhere discloses or suggests a polarizable electrode containing activated carbon as presently described in the claimed invention. Accordingly, withdrawal of the rejection of Claim 3 under 35 U.S.C. 102(b) over Armstrong is respectfully requested.

The rejection of Claim 10 under 35 U.S.C. 102(b) over Sonobe et al. (U.S. 6,258,337) is moot due to the cancellation of Claim 10.

Sonobe describes a carbonaceous electrode material for an electric double layer capacitor having a low resistivity and large bulk density. Nowhere does this reference disclose or suggest limits of alkali and heavy metals for the carbonaceous material as in the claimed invention. Likewise, nowhere does this reference teach washing the material to remove alkali or heavy metals. The Office has referenced the text beginning in Col. 5, line 58 and bridging to Col. 6, as showing the activated carbon being treated with NaOH. However, the text cited describes electrolyte solutions for use in a unit cell of an electric double layer capacitor and not a treatment method for preparing the activated carbon.

In view of the above, Applicants respectfully request withdrawal of the rejection of Claim 10 under 35 U.S.C. 102(b) over Sonobe.

The rejection of Claim 10 under 35 U.S.C. 102(a) over Shinozaki et al. (U.S. 2002/0096661) is moot in light of the cancellation of Claim 10.

Shinozaki describes a process for preparing a carbon material for an electric double layer capacitor electrode by control of pore volume. Shinozaki states that the carbon material contains preferably, at most 500 ppm alkali metal [0042]. The examples listed in Table 1

have K concentrations ranging from 100 to 600 ppm. Nowhere does this reference disclose, suggest or provide motivation to one of ordinary skill in the art which would lead to the claimed invention wherein the **total alkali metal content** is 60 ppm or less. Moreover, the reference is silent regarding heavy metal content.

In view of the above, Applicants respectfully request withdrawal of the rejection of Claim 10 under 35 U.S.C. 102(a) over Shinozaki.

The rejection of Claims 11-22, 24 and 27 under 35 102(b) or in the alternative under 35 U.S.C. 103(a) over Otowa (U.S. 5,064,805) is moot in view of the cancellation of Claims 11-22, 24 and 35.

Otowa describes a method of producing an activated carbon having a low sulfur content based on treatment of **coconut shell char**. Nowhere does this reference disclose or suggest a **polarizing electrode for an electrical double layer capacitor**, comprising: an activated carbon; at least one binder; and a conductive material, wherein the activated carbon is obtained by subjecting an easily **graphitizable carbonaceous material** to an alkali activation treatment, has an overall content of **alkali metals of 60 ppm or less**, and the easily **graphitizable carbonaceous material** is one selected from the group consisting of a petroleum coke, a petroleum pitch, a synthetic mesophase pitch, a polyvinyl chloride, a polyimide and a polyacrylonitrile.

In view of the above, Applicants respectfully submit that the cited reference can neither anticipate nor render obvious the claimed invention. Accordingly, withdrawal of the rejection of Claims 11-22, 24 and 27 under 35 102(b) or in the alternative under 35 U.S.C. 103(a) over Otowa is respectfully requested.

The rejection of Claims 20 and 23 under 35 U.S.C. 103(a) over Otowa in view of Shawabkeh et al. (U.S. 6,225,256) is moot in view of the cancellation of these claims.

The deficiency of Otowa relative to the presently claimed invention is described above. Shawabkeh is cited to show hydrogen peroxide as an oxidizing agent.

Shawabkeh describes an activated carbon and a method to produce the activated carbon using **pecan hulls**. Nowhere does this secondary reference disclose or suggest an easily graphitizable carbonaceous material selected from the group consisting of a petroleum coke, a petroleum pitch, a synthetic mesophase pitch, a polyvinyl chloride, a polyimide and a polyacrylonitrile.

Moreover, Shawabkeh neither discloses nor describes a polarizing electrode for an electrical double layer capacitor according to the presently claimed invention. Accordingly, the cited reference does not cure the deficiencies of Otowa and Applicants respectfully submit that the combination of references cannot render the claimed invention obvious. Withdrawal of the rejection of Claims 20 and 23 under 35 U.S.C. 103(a) over Otowa in view of Shawabkeh et al. (U.S. 6,225,256) is respectfully requested.

The rejection of Claims 24-30 under 35 U.S.C. 103(a) over Shawabkeh is moot in view of the cancellation of Claims 24-30, herein.

Applicants respectfully note that the presently claimed invention describes a polarizing electrode for an electrical double layer capacitor, comprising: an activated carbon; at least one binder; and a conductive material, wherein the activated carbon is obtained by subjecting an easily graphitizable carbonaceous material to an alkali activation treatment, has an overall content of alkali metals of 60 ppm or less. In citing Shawabekeh, the Office has stated: :Optimization of the order of steps, temperatures, concentrations, etc. does not impart patentability. *In re Boesch*, 205 USPQ 215, 219 (CCPA 1980)."

Applicants respectfully refer to *In re Antonie*. 559 F.2d 618, 195 USPQ 195 (CCPA 1977) which states:

“Exception to rule that discovery of optimum value of variable in known process is normally obvious occurs when parameter optimized was not recognized to be result effective variable.”

Applicants respectfully submit that nowhere does the cited reference disclose or suggest a method to remove alkali metals and/or heavy metals and nowhere does this reference even describe or refer to the concentration of either type of metal. Accordingly, even though the reference may describe various wash procedures, Applicants respectfully submit that a conclusion of obviousness cannot be supported based on the cited reference as it does not disclose or suggest alkali and heavy metal concentration as a related variable.

Accordingly, withdrawal of the rejection of Claims 24-30 under 35 U.S.C. 103(a) over Shawabkeh is respectfully requested.

Applicants have shown in the Examples that specific treatment methods are required to obtain activated carbons with alkali metal content of 60 ppm or less and/or heavy metal content of 20 ppm or less. Thus in Example A, the criticality of carbonated water in a water, carbonated water, HCl, water sequence is demonstrated. In Example B, the criticality of a basic wash in a water, basic wash, acid wash water sequence is demonstrated. In Example C the criticality of an HCl/hydrogen peroxide combination in the sequence water acid/peroxide, water sequence is demonstrated. In each of the examples the polarizing electrode obtained according to the claimed invention showed significant improvement in Rate of Self-discharge retention over the comparative electrode.

Applicants respectfully submit that none of the cited references disclose or suggest alkali and heavy metal contents as claimed and therefore the polarizing electrode for an electrical double layer capacitor and the specific methods as claimed cannot be obvious over any of the cited references.

The rejection of Claims 24-30 under 35 U.S.C. 112, second paragraph, is obviated by appropriate amendment. The term “hot” is not included in the newly stated claims.

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Applicants respectfully submit that the above-identified application is now in condition for allowance and early notice of such action is earnestly solicited.

Respectfully submitted,

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